On the basis of Weiss theory of ferromagnetism how will you explain curie point.

→ Weiss in 1907, postulated that in ferromagnetic materials, the internal field seen by a given ~~di~~ dipole is equal to the applied field plus a contribution from neighbouring dipoles which tend to align it in the same direction as it neighbours. Mathematically it may be written as

$$H_i = H + H_m \quad \text{with } H_m \propto M$$

i.e $$\boxed{H_i = H + \gamma M} \longrightarrow (1)$$

Where H_i is the internal field, H_m is the internal molecular field and γ is the Weiss molecular field constant.

The magnetisation M of the ferromagnetic is given by

$$M = \frac{N\mu^2}{3K_BT}(H + \gamma M)$$

$$\text{or, } \chi = \frac{M}{H} = \frac{N\mu^2}{3K_BT} + \gamma \frac{M}{H}\frac{N\mu^2}{3K_BT}$$

$$= \frac{C}{T} + \gamma\chi\frac{C}{T}$$

$$\text{or, } \chi\left(1 - \gamma\frac{C}{T}\right) = \frac{C}{T}$$

$$\Rightarrow \chi = \frac{C}{T - \gamma C} = \frac{C}{T - \theta}$$

Which is Curie-Weiss law and θ is called Curie temperature. From the above relation $T = \theta$ when $\chi \to \infty$ and for temperatures less than θ $(T > \theta)$, the relation does not signify any meaning. This means there exists a spontaneous magnetisation even in the absence of external magnetic field. The material is ferromagnetic below Curie temperature, Θ and becomes paramagnetic above curie temperature. Thermal agitation opposes the tendency of Weiss molecular field to allign the molecular magnets. But below curie temperature Weiss field energy overpowers the thermal agitation. Consequently, alignment of most molecular magnets results giving rise to magnetisation of the material even in the absence of applied field — the so called phenomenon of spontaneous magnetisation.

State the criteria for ferro-magnetism according to Weiss theory.

→ It is a phenomenon of spontaneous magnetisation. These materials can be magnetised and retain magnetism even if the external applied field is removed.
e.g Fe, Co, Ni, Cd, Dy and their alloys.

- The magnetic dipole moment per unit volume $\vec{M}$ produced in such substances is very high even in weak magnetic fields.

- The value of M is not linearly proportional to the applied magnetic field $\vec{B_a}$ i.e $\chi_m = \frac{\mu_0 M}{B_a}$ is not constant but varies with the applied field.

- Above a certain critical temperature called as Curie temperature T_c these behave as paramagnetic substances. These obey the curie-Weiss law $\chi_m = \frac{C}{T-T_c}$ for $(T > T_c)$

The susceptibility has a singularity at $T=T_c$. At this temperature and below it there exists a spontaneous magnetisation as χ_m is infinite as we have a finite value of $\vec{M}$ even if applied field Ba is zero. This is because the interaction between magnetic ions is strong enough to align their magnetic moments against the disorder produced by the "thermal effects" at temperature (T) above curie temperature (T_c) the spontaneous magnetisation vanishes.
Thus the curie temperature (T_c) separates the disordered paramagnetic phase at $(T > T_c)$ from ordered ferromagnetic phase at $(T < T_c)$